WE CLAIM:

1. A disposable blood pumping unit adapted to pump [biological fluid such as] blood, the pumping unit comprising:

a pump housing having a blood pumping chamber therein, and having an inlet and an outlet communicating with the pumping chamber;

a stator having a proximal end and a distal end with the proximal end connected to the pump housing and the distal end extending into the pumping chamber, the stator defining a central axis;

a bearing supported at the distal end of the stator and aligned with the central axis;

a rotator positioned within the pumping chamber and supported on the bearing for rotation about the central axis, the rotator having a hub and a plurality of openings configured to expose the bearing to the [fluid] blood, the rotator including an underside; and

magnetic means carried by the rotator within the pumping chamber, the magnetic means disposed inside of the rotator;

wherein a portion of the blood pumping chamber disposed beneath the underside of the rotator communicates with a remainder of the pumping chamber at an outer periphery of the rotator and is unobstructed from the outer periphery of the rotator to the hub.

2. The pumping unit of claim 1 wherein the pump housing comprises:

a housing cap having the inlet generally aligned with the central axis for routing fluid into the pumping chamber;

a housing base secured to the housing cap thereby enclosing the pumping chamber therein; and

an annular fluid-tight seal between the housing cap and base.

3. The pumping unit of claim 2 wherein the stator is conical-shaped with the proximal end having a larger radius than the distal end, and wherein the proximal end is secured to the housing base.

4. The pumping unit of claim 1 wherein the stator is conical-shaped having a maximum and a minimum radial dimension, with the proximal end having the maximum radial dimension and the distal end having the minimum radial dimension.

5. The pumping unit in claim 4 wherein the stator comprises a proximal section and a distal section, the proximal section constructed out of a polymer material, the distal section constructed out of hardcoated aluminum.

6. The pumping unit of claim 1 wherein the stator comprises:

a stator base shaped as a frustal cone with a trapezoidal cross-section along the central axis, the stator base having a maximum radial dimension and a minimum radial dimension, the maximum radial dimension defining the proximal end of the stator; and

a spindle having first and second opposite ends aligned with the central axis, the first end attached to the minimum radial dimension of the lower section of the stator and the second end defining the distal end of the stator.

7. The pumping unit of claim 6 wherein the bearing is formed integral with the second end of the spindle.

8. The pumping unit of claim 1 wherein the bearing is a ball-shaped pivot bearing.

9. The pumping unit of claim 8 wherein the pivot bearing is hardcoated aluminum.

10. The pumping unit of claim 1 wherein the bearing is fixed to the distal end of the stator.

11. The pumping unit of claim 1 wherein the bearing is formed integral with the distal end of the stator.

12. The pumping unit of claim 1 wherein the bearing is fixed to the hub of the rotator at the central axis.

13. The pumping unit of claim 1 wherein the bearing is formed integral with the rotator at the central axis.

14. The pumping unit of claim 1 wherein the rotator is a generally conical-shaped impeller with a maximum radial end adjacent to the proximal end of the stator and a minimum radial end supported by the bearing.

15. The pumping unit of claim 1 wherein the rotator comprises a plurality of concentric cone-shaped rotators with maximal radial ends adjacent to the proximal end of the stator and with minimal radial ends supported by the bearing.

16. The pumping unit of claim 1 wherein the magnetic means comprises an annular magnetic ring having a plurality of magnetic poles.

17. The pumping unit of claim 1 wherein the magnetic means comprises a plurality of circumferentially spaced magnets.

18. The pumping unit of claim 1 wherein the magnetic means are positioned such that the magnetic lines of force are substantially directed toward the bearing and the central axis.

19. A centrifugal blood pump adapted to pump [biological fluid such as] blood, the pump comprising:

a pump housing having a pumping chamber therein, and having an inlet and an outlet communicating with the pumping chamber;

a stator having a proximal end and a distal end with the proximal end connected to the pump housing and the distal end extending into the pumping chamber, the stator defining a central axis;

a bearing supported at the distal end of the stator and being aligned with the central axis;

a rotator positioned within the pumping chamber and supported on the bearing for rotation about the central axis, the rotator having a hub and a plurality of openings configured to expose the bearing to the [fluid] blood, the rotator including an underside;

magnetic means carried by the rotator and disposed inside of the rotator; and

magnetic drive means for releasable connection to the pump housing to communicate with the magnetic means carried by the rotator and thereby to rotate the rotator within the pumping chamber,

wherein a portion of the blood pumping chamber disposed beneath the underside of the impeller communicates with a remainder of the pumping chamber at an outer periphery of the impeller and is unobstructed from the outer periphery of the impeller to the hub.

20. The centrifugal pump of claim 19 wherein the pump housing comprises:

a housing cap having an inlet generally aligned with the central axis for routing fluid into the pumping chamber;

a housing base secured to the housing cap thereby enclosing the pumping chamber therein; and

an annular fluid-tight seal between the housing cap and base.

21. The centrifugal pump of claim 20 wherein the stator is conical-shaped with a maximum radius at the proximal end and a minimum radius at the distal end, and having the proximal end secured to the housing base.

22. The centrifugal pump of claim 19 wherein the stator is conical-shaped having a maximum and a minimum radial dimension with the proximal end having the maximum radial dimension and the distal end having the minimum radial dimension.

23. The centrifugal pump in claim 22 wherein the stator comprises a proximal section and a distal section, the proximal section constructed out of a polymer material, the distal section constructed out of hardcoated aluminum.

24. The centrifugal pump of claim 19 wherein the stator comprises:

a stator base shaped as a frustral cone with a trapezoidal cross-section along the central axis, the stator base having a maximum radial dimension and a minimum radial dimension, the maximum radial dimension defining the proximal end of the stator; and

a spindle having first and second opposite ends aligned with the central axis, the first end attached to the minimum radial dimension of the lower section of the stator and the second end defining the distal end of the stator.

25. The centrifugal pump of claim 24 wherein the bearing is formed integral with the second end of the spindle.

26. The centrifugal pump of claim 19 wherein the bearing is a ball-shaped pivot bearing.

27. The centrifugal pump of claim 26 wherein the pivot bearing is hardcoated aluminum.

28. The centrifugal pump of claim 19 wherein the bearing is fixed to the distal end of the stator.

29. The centrifugal pump of claim 19 wherein the bearing is formed integral with the distal end of the stator.

30. The centrifugal pump of claim 19 wherein the bearing is fixed to the hub of the rotator at the central axis.

31. The centrifugal pump of claim 19 wherein the bearing is formed integral with the rotator at the central axis.

32. The centrifugal pump of claim 19 wherein the rotator is a generally conical-shaped impeller with a maximum radial end adjacent to the proximal end of the stator and a minimum radial end supported by the bearing.

33. The centrifugal pump of claim 19 wherein the rotator comprises a plurality of concentric cone-shaped rotators with maximal radial ends adjacent to the proximal end of the stator and with minimal radial ends supported by the bearing.

34. The centrifugal pump of claim 19 wherein the magnetic means comprises an annular magnetic ring having a plurality of magnetic poles.

35. The centrifugal pump of claim 19 wherein the magnetic means comprises a plurality of circumferentially spaced magnets.

36. The centrifugal pump of claim 19 wherein the magnetic means are positioned such that the magnetic lines of force are substantially directed toward the bearing and the central axis.

37. The centrifugal pump of claim 19 wherein the magnetic drive means comprises:

a rotor positioned adjacent to the pump housing; and

a plurality of drive magnets angularly spaced about the circumference of the rotor and oriented with the magnetic lines of force generated by the drive magnets aligning with the magnetic lines of force generated by the magnetic means carried by the rotator and intersecting the central axis such that resulting unbalanced forces on the rotator hub are substantially in a downward direction from the bearing at the distal end of the stator toward the proximal end of the stator, the resulting unbalanced forces being generally parallel to the central axis thereby stabilizing the rotation of the rotator about the bearing and the central axis.

38. A disposable blood pumping unit adapted to be releasably mounted on a magnetic drive means for pumping [biological fluid such as] blood, the pumping unit comprising:

a pump housing having a blood pumping chamber therein, and an inlet and an outlet communicating with the pumping chamber;

a bearing supported in the pumping chamber;

an impeller positioned within the pumping chamber, the impeller having a hub rotatably supported on the bearing for rotation about an axis and having a plurality of openings configured to expose the bearing to the [fluid,] blood, the impeller including an underside; and

magnetic means carried by the impeller within the pumping chamber adapted to be magnetically coupled with a magnetic drive means to rotate the impeller, and thereby pump [fluid] blood through the pumping unit, the magnetic means disposed inside of the impeller;

wherein a portion of the blood pumping chamber disposed beneath the underside of the rotator communicates with a remainder of the pumping chamber at an outer periphery of the rotator and is unobstructed from the outer periphery of the rotator to the hub.

39. A disposabl pumping unit according to claim 38 wherein the bearing is supported generally adjacent the inlet for the flow of incoming fluid over the bearing.

40. A disposable pumping unit according to claim 39 wherein the bearing and the inlet are aligned along the axis of rotation of the impeller.

41. A disposable pumping unit according to claim 40 wherein the direction along the axis of rotation of the impeller from the bearing toward the inlet constitutes the upstream direction, the magnetic means forming magnetic lines of force intersecting the axis of rotation of the impeller upstream of the bearing.

42. A disposable pumping unit according to claim 40 wherein the magnetic means forms magnetic lines of force intersecting the bearing.

43. A disposable blood pumping unit adapted to pump [biological fluid such as] blood, the pumping unit comprising:

a pump housing having a blood pumping chamber therein, and an inlet and an outlet communicating with the pumping chamber;

a bearing supported in the pumping chamber;

an impeller positioned within the pumping chamber, the impeller having a periphery, a plurality of radial blades which extend to the periphery of the impeller and a hub which is rotatably supported on the bearing for rotation about an axis and is positioned between the inlet and the bearing, the radial blades defining a plurality of openings configured to expose the bearing to incoming [fluid] blood from the inlet, the impeller including an underside;

magnetic means carried by the impeller about the periphery and forming magnetic lines of force which intersect the axis of rotation of the impeller such that resulting balanced and unbalanced forces on the impeller stabilize rotation about the bearing and the axis, the magnetic means disposed inside of the impeller;

wherein a portion of the blood pumping chamber disposed beneath the underside of the impeller communicates with a remainder of the pumping chamber at an outer periphery of the rotator and is unobstructed from the outer periphery of the rotator to the hub.

44. The disposable pumping unit of claim 43 wherein a direction along the axis of rotation of the impeller from the bearing toward the inlet constitutes an upstream direction and wherein the magnetic lines of force intersect the axis of rotation of the impeller upstream from the bearing.

45. The disposable pumping unit of claim 43 wherein the magnetic lines of force intersect the axis of rotation f the impeller at the bearing.